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COVER: HM3 James F. DeJanon examines a patient at Branch Medical Clinic, Marine Corps Recruit Depot, San Diego, CA. As the Hospital Corps celebrates its 95th anniversary, corpsmen continue a proud tradition of service to the Navy and Marine Corps. Story on page 12.

Branch Navy Hospital Adak to the Rescue

At 0230 on 6 April 1993, the duty officer at U.S. Branch Navy Hospital Adak received a phone call for help. It was from the sole Air Force medical officer at Shemya Air Force Base, Shemya Island, AK. A civilian Chinese airline was attempting an emergency landing.

The pilot stated that he had many seriously injured passengers and needed to land immediately. Attempts by Branch Navy Hospital Adak to divert the airliner to Adak, where medical capabilities are more readily available, were futile. The traumatic air turbulence that injured more than half the 265 passengers aboard had seriously damaged the aircraft, and the pilot was unsure of its airworthiness.

At 0355 the airliner and its injured landed at Shemya AFB—325 miles west of Adak in the Aleutian chain, with a staff of one medical officer and three medics. They called Navy medicine, which was standing by, ready to assist.

The 15-bed, 75-person Branch Navy Hospital immediately initiated a total staff recall. By 0410 everyone had arrived. Within an hour, a 12-member

Left to right: **HM1 Geoffrey Hughes, HM3 Jason Farlow, and LT Jeff McNeil prepare to place an IV into one of the victims of the Chinese airliner accident.**

HM3 Dennis Matlock, LT Brian Smullen, and LCDR Chris Stokke check vital signs as HMC Robert Spindle looks on.

medical team was identified for mobilization to Shemya, contingency supplies were gathered, and people and packages were loaded aboard a P-3 from VP-40's Fighting Marlins, an air squadron stationed at NAS Adak.

Upon landing at Shemya, about an hour after takeoff, the team quickly assessed the situation and called for additional supplies and medical staff. Again, Branch Navy Hospital Adak was standing by to assist and answered the call. An additional 13 staff members and the urgently needed medical supplies were soon aloft in NAS Adak's C-130 transport and arrived at Shemya by 0900.

The three medical officers, two nurse anesthetists, one Medical Service Corps officer, and six hospital corpsmen of the Branch Navy Hospital's first team were joined by three Nurse Corps officers, another Medical Service Corps officer, one Army veterinarian, one Army vet tech, and seven more hospital corpsmen.

As Adak's teams arrived, they immediately joined the four on-site Air Force medical personnel in triaging the 265 passengers, many of whom were very critically injured and were still inside the MD-11, a modified DC-10 aircraft.

Triage and immediate lifesaving procedures took an hour and a half. Then medical evacuation could begin. Using an Air Force RC-135 that had been at Shemya at the time of the crisis, the first 27 critically injured passengers were medevaced to Anchorage. With them were Navy physicians, nurses, and corpsmen, who provided inflight medical care. At Shemya, triage and treatment continued, and the joint Navy-Army-Air Force medical team prepared and evacuated 10 more critical patients to Anchorage, using the P-3 that had brought the first Navy medical team to the scene.

By 1100, 15 additional patients had been evacuated via a Coast Guard C-130. Finally, at 1228, the last of the seriously injured passengers were evacuated off Shemya Island by NAS Adak's C-130, which carried 38 patients attended by 4 Navy medical personnel.

In the space of 8 hours, the Branch Navy Hospital had mobilized 25 staff personnel, moved more than 2 tons of supply items, and provided lifesaving treatment and medical evacuation of 89 critically and seriously injured passengers. By 1500 the 60 less seriously injured passengers had been evacuated by an Air Force C-141.

News service reports indicated one passenger died of his injuries. Without U.S. Branch Navy Hospital Adak's rapid and capable response, the toll would have been higher. □

—Story by HMCM(SW) Clifford Phillips, Command Master Chief, Director for Administration, U.S. Branch Navy Hospital, Adak, AK. Photos by JO1 Walter H. Panych.

Flag Officer Selectees

RADM-selectee **James Howard Black,** MC, assistant chief of staff for fleet medical/fleet surgeon on the staff of the Commander in Chief U.S. Pacific Fleet, Pearl Harbor, HI, was born in Camp Hill, PA. He received his B.A. degree from Gettysburg College, Gettysburg, PA, and his D.O. degree from Philadelphia College of Osteopathic Medicine, Philadelphia, PA. He completed a rotating internship and an anesthesiology residency at Fort Worth Osteopathic Hospital, Fort Worth, TX. Subsequently, Dr. Black entered private practice and served as a member of the Admissions Committee and was appointed clinical instructor at the Texas College of Osteopathic Medicine during 1973 and 1974.

After being commissioned in the Medical Corps, he completed a course in aerospace medicine at the Naval Aerospace Medical Institute in Pensacola, FL, and was designated a flight surgeon in March 1975. Subsequent duty assignments include: senior medical officer, USS *Ranger* (CV-61); head, Aerospace Physical Examination Review Section, Bureau of Medicine and Surgery; assistant for medical officer distribution, Bureau of Medicine and Surgery; senior Medical Corps assignment officer, Naval Military Personnel Command; regional healthcare coordinator, Naval Regional Medical Center, Oakland, CA; commanding officer, Naval Hospital, Oak Harbor, WA; commanding officer, Naval Hospital, Yokosuka, Japan; and force medical officer, Naval Surface Force United States Pacific Fleet.

Dr. Black is affiliated with the American Osteopathic Association; Association of Military Surgeons of the United States; Association of Military Osteopathic Physicians and Surgeons (past president 1982-1984); Texas Osteopathic Medical Association; Society of U.S. Naval Flight Surgeons; Aerospace Medical Association; member, Joint Committee of Aviation Pathology (1977-1980); member, Naval Aviation Evaluation Board at Chief of Naval Personnel (1977-1982); military representative, Alumni Board of the Philadelphia College of Osteopathic Medicine; member, Committee on Postdoctoral Training of the A.O.A. (1984-1986), San Diego Osteopathic Medical Association; and delegate, A.O.A. House of Delegates on six occasions.

His military awards include the Legion of Merit (two awards), Meritorious Service Medal with gold star (two awards), Navy Commendation Medal, Meritorious Unit Commendation, Sea Service Ribbon, and Overseas Service Ribbon (with two bronze stars).

CAPT James H. Black, MC

RADM-selectee **Noel K. Dysart,** MC, assistant chief for plans, analysis and evaluation, Bureau of Medicine and Surgery, is a native of east St. Louis, IL. He attended several colleges in Minnesota and received his B.A. degree from the University of Minnesota in 1967.

Following acceptance to medical school, he was commissioned an ensign in the Navy 1915 Early Commissioning Program in May 1966. He received his medical degree from the University of Minnesota on 10 June 1970 and completed a straight pediatric internship followed by 1 year of pediatric residency at Children's Orthopedic Hospital and the University of Washington, Seattle, WA.

He was assigned to the Naval Hospital, Bremerton, WA, as a pediatrician in June 1973 and then moved to San Diego, CA, for a final year of residency and a 2-year assignment as a staff pediatrician before moving to the University of Minnesota for a 2-year fellowship in pediatric nephrology.

Subsequently, he returned to San Diego where he was assigned as a staff pediatric nephrologist with additional responsibilities as director of The Electron Microscopy Laboratory in the Clinical Investigation Center. During this tour, he was the operational medicine training coordinator and the director of interns. In 1982, he was assigned to the Naval Health Sciences Education and Training Command as director, Medical Corps Programs and Clinical Investigations. Shortly thereafter, he transferred to the newly

CAPT Noel K. Dysart, MC

created position of assistant for professional education, Office of the Director of Naval Medicine. After serving as director, Medical Education and Training (OP-939), Dr. Dysart reported to Naval Hospital, Roosevelt Roads, Puerto Rico, as executive officer in July 1986. From June 1988 to June 1990, he served as executive officer of the Naval Health Sciences Education and Training Command. Following a 2-year tour as commanding officer, Naval Hospital, Groton, CT, he assumed command of Naval Hospital, Jacksonville, FL, in June 1992. In April 1993, Dr. Dysart reported to the Bureau of Medicine and Surgery.

Dr. Dysart is certified by the American Board of Pediatrics and holds state licenses in Washington and Minnesota. He has authored or coauthored nine articles published in medical literature. He is a member of Alpha Omega Alpha, the American Academy of Pediatrics, American Medical Association, American Society of Nephrology, and Association of Military Surgeons of the United States. He is past alternate chapter chairman and past president of the Uniformed Services Chapter East of the American Academy of Pediatrics. His awards include the Legion of Merit, Meritorious Service Medal with gold star, Navy Commendation Medal, and National Defense Medal with bronze star.

RADM-selectee **M. Eugene Fussell,** MC, USNR, force medical officer, Reserve Naval Construction Force, Gulfport, MS, and reserve specialty advisor to the Surgeon General in orthopaedic surgery, Bureau of Medicine and Surgery, is a native of Blackshear, GA. He received his B.S. degree in chemistry from Morehouse College, Atlanta, GA, in 1959 and his doctorate degree from Meharry Medical College, Nashville, TN, in 1964. While a freshman medical student, he was commissioned an ensign, United States Naval Reserve in the 1915 program. He did three internships at U.S. Naval Hospital, Bethesda, MD, in the summers of 1961, 1962, and 1963.

After completing a rotating internship at George W. Hubbard Hospital, Meharry Medical College, he was called to active duty in June 1966. He was assigned to the ADCOM Command at Great Lakes Naval Training Center, Great Lakes, IL. Subsequently, he was augmented to the Regular Navy and was assigned as a first-year resident in general surgery at U.S. Naval Hospital, St. Albans, NY, in June 1967. In 1968, he was assigned to U.S. Naval Hospital, San Diego, CA, as a second-year resident in orthopaedic surgery. He completed his residency in 1970 and then served as chief of orthopaedic surgery, U.S. Naval Hospital, Port Hueneme, CA, at the Construction Battalion Center. He became board certified in orthopaedic surgery in 1972 and in September of that year, Dr. Fussell resigned his regular commission and became a reservist. In addition, he began private practice in Oxnard, CA.

His first reserve assignment was consultant to the commanding officer, U.S. Naval Hospital, Port Hueneme, CA. He served in this capacity for 3 years and then became officer in charge, 1st MARDIV MED Detachment, Camp Pendleton, CA. Subsequently, he became commanding officer of NR NAVHOSP Unit Camp Pendleton, NR NAVMEDCL 119

CAPT M. Eugene Fussell, MC, USNR

(Port Hueneme), and NR NAVHOSPCPEND. From 1987 to 1990, Dr. Fussell served as director, health services, COMNAVREDRESCOM Reg 19, San Diego, the largest REDCOM in the nation.

During the Marine Corps Cold Winter '89 exercise in Norway, Dr. Fussell served as brigade surgeon. In 1991 he was selected to work on an elite group of naval officers to serve on OP-06 Innovative Naval Reserve Workshop, Newport, RI.

In civilian life, Dr. Fussell participates in several civic activities. He was chief of staff at St. John's Regional Medical Center in Oxnard and now serves on the board of directors of St. John's Pleasant Valley Hospital in Camarillo, CA, and St. John's Regional Medical Center in Oxnard. He is a fellow of the American Academy of Orthopaedic Surgeons and a diplomate of the American Board of Orthopaedic Surgery. He is also a member of the National Medical Association, American Medical Association, and California Medical Association.

In addition, Dr. Fussell is a life member of the Naval Reserve Officer Association, Reserve Officer Association, Flying Physicians Association, and U.S. Naval Institute. His military decorations include the Meritorious Service Medal. □

Commander Seventh Fleet Conducts First Medical Symposium

Medical care throughout the world varies as much as the culture, customs, and the foods it eats. For sailors and troops deployed overseas, finding this quality care in unfamiliar parts of the globe can be a life or death search.

In an effort to identify medical care facilities in the western Pacific and to exchange medical information and expertise, Commander, U.S. Seventh Fleet recently held its first-ever Western Pacific Medical Symposium for Surgeons General from regional nations on 6-8 April 1993.

"It was another step in the growing cooperation between the United States and the nations of the Asia-Pacific region. I think a lot of goodwill came from sharing ideas and concerns," said VADM Tim Wright, Commander, U.S. Seventh Fleet.

One of the greatest concerns for the Seventh Fleet is identifying medical facilities within its 52-million-square-mile area of responsibility which can be accessed in a medical evacuation or contingency situation. Although all U.S. Navy ships have trained medical personnel and facilities, shipboard capabilities can only, in most cases, stabilize patients with serious injuries and illnesses until they can be transported to modern hospitals for definitive treatment.

"We sometimes have to rely on the indigenous facilities (of some countries) as some of our ships transit through, particularly the combatants and smaller ships which don't have extensive medical capabilities. The Western Pacific Medical Symposium for Surgeons General is a very significant initiative. The fact that nations are sending such senior medical personnel is indicative of the importance they attach to it, and we certainly concur," continued VADM Wright.

Attending Seventh Fleet's Western Pacific Medical Symposium for Surgeons General were senior medical officers from Indonesia, Malaysia, Philippines, Thailand, and Japan. In addition to the opportunity to exchange professional information and background on each nations' medical service, symposium attendees toured shipboard medical facilities in the aircraft carrier USS *Independence* (CV-62) and in the Seventh Fleet Flagship, USS *Blue Ridge* (LCC-19); toured Naval Hospital Yokosuka and Sagami Army Contingency Hospital; and received briefings on the mission of U.S. Seventh Fleet and the Navy's future outlook defined in ". . . From the Sea."

Commander in Chief Pacific Fleet Surgeon, CAPT James H. Black and Japan Maritime Self-Defense Force Surgeon General, RADM Hiromichi Oiwa also attended the symposium and made remarks to the multinational force surgeons general.

CAPT M. Hollis Tanksley, Seventh Fleet Surgeon, says he initiated the

Photo by PHAN Maurice Dayao

USS *Independence*'s senior medical officer, CDR Dennis Deakins, shows the aircraft carrier's medical facilities to senior medical personnel.

Photo by CDR Alan Dooley, USN

Surgeons General from Malaysia, Indonesia, Thailand, Japan, and the United States gather in the operating room of USS *Blue Ridge*.

conference because it was apparent to him, during visits to nations in the western Pacific with the Fleet Commander, that the U.S. Navy's medical role and responsibility in that area was not well understood. Additionally, the medical capabilities of those nations were not well known to the U.S. Navy, explained CAPT Tanksley, and a common ground was needed. With that goal in mind, the first Western Pacific Medical Symposium was orchestrated.

"To have interoperability, you have to have a beginning point and I hope this symposium is the first step. This gives us the opportunity to start or continue a dialogue with those nations we interact with," said CAPT Tanksley.

CAPT Tanksley hopes that more medical symposia will be conducted in the future to explore deeper areas of the medical profession dealing with equipment, infectious diseases, medevac procedures, and possibly combined medical exercises.

According to Assistant Seventh Fleet Surgeon's, HMCS William Charron, organizing and hosting a medical symposium at the U.S. Navy's forward-deployed base in Yokosuka, Japan, required a little more advance planning than just compiling a schedule of events. Obtaining the required country clearance for the multinational medical officers required liaison with the Japan Maritime Self-Defense Force, Commander U.S. Forces Japan, and Commander, Naval Forces Japan.

"No small share of the credit goes to our Japanese hosts who have been very gracious and took an active role in the presentations," stated VADM Wright.

The importance of understanding the medical capabilities in regions where soldiers, sailors, airmen, and marines operate is vital to force substainability and survivability. This was most apparent during a recent medical evacuation of a woman sailor aboard USS *Cape Cod* who suffered from an acute appendicitis. With the ship steaming toward the Persian Gulf and the nearest land being India, quick decisions were required to get the ailing sailor prompt medical attention. Because the Seventh Fleet flagship visited Madras, India, several months earlier and medical facilities within India were explored by CAPT Tanksley during that visit, it was determined that quality treatment was available in the area.

"We had to medevac that person ashore and because we were familiar with the nearby medical facilities, we were able to get her to a hospital where she underwent surgery, did very well, and is now fully recovered," recalled VADM Wright.

Seventh Fleet's first-ever Western Pacific Medical Symposium for Surgeons General has opened the door for further discussions to understand the medical care facilities and practices in the region where the Seventh Fleet operates. With a solid foundation established, quality medical care for U.S. sailors, marines, airmen, and soldiers is quickly becoming available—wherever they operate. □

—LT James E. Brooks and CDR Norris Jones, Commander Seventh Fleet Public Affairs Office.

Naval Medical Research and Development Command Highlights

Bethesda, MD

• New Submarine Rescue Manual

The Naval Submarine Medical Research Laboratory (NSMRL) provided undersea medical officers and submarine crew rescue teams with a valuable resource, the *Pressurized Submarine Rescue Manual* (NSMRL Report No. 1178, 22 June 1992), to assist in rescuing survivors of a disabled submarine. NSMRL scientists conducted extensive pulmonary oxygen toxicity and decompression research to establish the safe procedures outlined in the manual. Various methods of safe decompression from 132 fsw were explored and researchers developed decompression tables for air, nitrox, and trimix gas mixtures. Further work on decompressing with a trimix gas led to a 1.5 day decrease in decompression time when compared to standard saturation rates. The manual reviews concepts of pressure, hypoxia, hyperoxia, and atmosphere contamination. Factors affecting the decision of a crew to either escape to the surface or await rescue are examined. Included are algorithms (decision trees) which when incorporated with decompression procedures could be useful under a variety of rescue scenarios. The information in the manual represents a synthesis of material from many sources. The manual is intended to supplement the *Submarine Rescue Manual ATP 57* and the Search and Rescue Instructions ATP 10(d), Chapter 8. For more information contact CDR B. Schibly, MC, NMRDC Research Area Manager for Submarine and Diving Medicine, DSN 295-0879 or Commercial 301-295-0879.

* * *

• Radiofrequency Radiation Protective Suits

The Naval Aerospace Medical Research Laboratory (NAMRL), Pensacola, FL, has entered into a Cooperative Research and Development Agreement (CRDA) with Maxwell Safety Products, Ltd., of Smithtown, NY. This action is taken under the authority of the Federal Technology transfer Act of 20 Oct 1986, as amended. Under CRDA, Maxwell and the Bioengineering Division of NAMRL will work together to perform highly specialized tests regarding the effectiveness of NAPTEX™ radiofrequency radiation (RFR) protective suits. Using the uniquely valuable "human-equivalent" model development by NAMRL a series of irradiation tests will measure specific absorption rates (a measure of energy absorption within the human body). Reliable RFR protective suits are products that have been long-awaited and anticipated by industries that use radiofrequency technology. The principal investigator for NAMRL will be Dr. Richard G. Olsen, Head, Bioengineering Division. For more information contact CDR J.R. Beddard, MSC, NMRDC Research Area Manager for Fleet Occupational Health, DSN 295-0885 or Commerical 301-295-0885.

* * *

• Genetics of Motion Sickness

Motion sickness and disorientation are significant operational concerns for the Navy and Marine Corps. Current studies have documented an unacceptably high incidence of motion sickness in aircrew and shipboard personnel. Studies also have recognized that, in the underwater environment, sensory conflicts, body fluid redistribution, and nitrogen narcosis make Navy divers highly susceptible to motion sickness. Researchers at the Naval Health Research Center, San Diego, CA; the Wayne State University School of Medicine, Detroit, MI; and the University of Michigan Medical School, Ann Arbor, MI, are investigating a new approach to the problem of motion sickness. They are focusing on the cellular and molecular physiology of gene expression to determine if a predisposition to motion sickness is an inherited trait. Genetic differences in the complement of receptors on autonomic neurons of the central and peripheral nervous system could explain the differences in an individual's susceptibility to motion sickness. Preliminary findings suggest that a genetic polymorphism of the alpha-2 adrenergic receptor (encoded by chromosome 10) is associated with development of motion sickness. This approach can also be used to understand the variations in human responses to other physical stresses in the operational environment, such as a predisposition to heatstroke or gravity-induced loss of consciousness. For more information contact Ms. Christine Eisemann, NMRDC Associate Director for Research Management, DSN 295-0882 or Commercial 301-295-0882.

The Cost of Avoiding Risk

CDR James A. Brown, MC, USN

Risk is inherent to the clinical practice of medicine. Every surgical intervention, prescribed medication, and many diagnostic studies entail potential hazards. The possibility of errors of omission and commission exists whenever patients are evaluated and treated, even when the caregiver is attentive, highly trained, and conscientious. Physicians constantly weigh the risk/benefit ratio in literally hundreds of daily decisions. The same is true for those in leadership positions, where numerous competing interests must be considered in every management decision. Effectiveness is dependent upon good judgment and decisiveness. Although risks must be minimized, they cannot be completely eliminated. To demand such is unrealistic.

"Cast out fear!" is one of the basic tenants of total quality leadership (TQL), today's management philosophy endorsed by Navy leadership in both line and medical communities. It means to sweep away the fear of failure. Yet, this concept requires some clarification. The fear of failure is not necessarily a bad thing; it shields one from the capricious pursuit of foolish or dangerous acts, and motivates when irresponsibility or sloth beckon. But the fear from which we need to be free is that which stifles creativity and moral courage simply because risk is involved.

In the mid-1980's well-trained Navy surgeons were encouraged to refer many patients who needed high-risk operations to CHAMPUS (Civilian Health and Medical Program of the Uniformed Services) because to incur a bad outcome, regardless of the appropriateness of the care rendered, was to place one's professional future in jeopardy. Or, more often, though not usually spoken, it was to jeopardize the commanding officer's professional future, which quietly translated to not surgically intervening without the promise of a predictably safe outcome. Fear stalked the corridors of naval hospitals, shadowed by a perceived need for perfection, which led to indecisiveness and professional stagnation. Consequently, complicated cases were sent elsewhere at greater expense to the patient and taxpayer, often for less than or, at best, equal quality of care. Meanwhile, Navy surgeons' skills atrophied and many qualified surgeons left active service to practice the full realm of their specialty in the civilian sector where they were most welcome.

Another costly attempt to eliminate risk is the implementation of restrictive policies after a single bad outcome. Certainly every complication should be carefully scrutinized for lessons learned, and policies to minimize risk should be developed. But extreme cases rarely make good policies, and the zeal to prevent recurrent complications often results in limitations upon the entire community in which the complication occurred. Nonphysician health care providers are particularly vulnerable to such restrictions. Consequently, policies such as the following might be put into effect: independent duty hospital corpsmen are not allowed to see dependents, physician assistants are forbidden to order a particular medication, nurse midwives are prohibited from ordering obstetrical ultrasounds without an obstetrician's approval, or certified registered nurse anesthetists are denied the opportunity to perform pediatric anesthesia. While designed to reduce risk, such policies only reduce availability of patient care and inhibit professional satisfaction. In spite of adequate training, a provider may be prohibited from practicing safely those skills that were arduously obtained.

Complex organizations such as hospitals require policies and guidelines in order to function smoothly and minimize the hazards of risk-prone activities. However, not only is it impossible to implement a policy for every contingency, but attempts to do so may actually increase risk by eliminating judgment from decision-making processes. The subsequent rigidity may limit the options of a provider or subordinant when common sense and creativity dictate better courses of action.

Leaders may skillfully avoid personal risk by transferring tough decisions elsewhere. For example, a problem may be referred to a committee when it ought to be decided by an individual who has the authority to make the decision, or "up the chain of command" when it ought to be decided at a lower level. Never mind that the committee may not meet more than quarterly, or a routing cover sheet on a proposal assures weeks of roaming from desk to desk. Responsibility is diluted by spreading it around, or shifting it to someone else's watch. But meanwhile, no one owns the problem and it festers unresolved, only to reappear on the same agenda months later.

Still another attempt to eliminate risk is the implementation of monitoring. Subsequently, more of one's already scarce personnel resources are expended in data collection, and another monthly report is prepared for someone's review. But there is no evidence that simple monitoring reduces risk. Actually, these statistical surveys may instead promulgate a false sense of security that problems have been resolved when in reality "monitoring" is all that is being done.

Important opportunities in clinical medicine and military leadership are irretrievably lost when a risk-free environment becomes imperative. It is true that one should never be cavalier with people's lives or well being, or take unnecessary risks. Many of life's tragedies could be avoided by adhering to well-established protocols learned from the mistakes of others. But the quest for safety can be an impediment to right action if it becomes the highest or the only goal of a physician or leader. Decisions become flawed when a leader's motive for personal safety exceeds concern for the best interest of the patient or subordinant. Decisions should be based on the merits of the various choices at hand, rather than by some spectre of power that is perceived as looking on or ready to question by hindsight. Decisions should rest on sound principle rather than political advantage; on conviction rather than personal expediency. Otherwise, at critical moments, even inherently noble leaders may yield to unspoken fears and retreat to positions of personal safety.

In 1936 Winston Churchill described the timidity of a British government paralyzed by fear, saying, "So they go on in strange paradox, decided only to be undecided, resolved to be irresolute, adamant for drift, solid for fluidity, all-powerful to be impotent." He recognized that fear impairs judgment and erodes one's ability to concentrate on the primary objective. In *Modern Times,* Paul Johnson wrote of how men of principle have an easier time making decisions because, when confronted with tough moral or ethical decisions, they have a foundation from which to decide. Personal risk becomes irrelevant when principles are clear. Minds are not clouded by ambivalence when individuals have already worked through the issues. On the other hand, those without principle waste emotional energy testing the direction of the political winds before making a decision. They do not weigh the virtues of various choices, but instead try to measure the outcome and calculate the personal cost of each option. Moral courage is doing the right thing regardless of the outcome.

The price for "risk-free" leadership and medical care is enormous. It is at the root of defensive medicine, driving up health care costs and wasting precious resources. Morale suffers and leaders lose credibility when they are viewed as placing self-interest ahead of sound judgment. Dangerous and sometimes mindless policies are implemented, typically under a pretense of protecting patients or subordinates, but actually designed to protect leaders if something goes wrong. Unfortunately, when a colleague makes a mistake, it is common to see others distance themselves from their fallen comrade. How many good leaders have been snuffed out for a mistake in their early years for which there was no opportunity for reconciliation? How many mediocre leaders have risen to the top by simply avoiding tough choices and playing a safe game?

Greatness is avoided when personal safety becomes a physician's or a leader's major goal. Fear inhibits creativity and fosters mediocrity. The sincerity of the Navy's commitment to TQL will be measured by its ability to cast fear aside. Navy medicine cannot afford the cost of avoiding every risk. □

Dr. James is assigned to the medical department aboard USS *Saipan* (LHA-2).

Navy Nurse Corps

85 Years of Service

Photos from BUMED Archives

Left: **1918—Two Navy nurses pose aboard USS *George Washington*. *Below:* 1922—Off duty nurses in Cuban waters display the day's catch aboard USS *Relief*.**

1944—Photographed at a base in the southwestern Pacific, four ensigns try on footware they will be wearing at their new duty stations.

1945—ENS Helen Zek learns the fundamentals of a coxswain's duties aboard an amphibious LCVP (landing craft vehicles and personnel.)

1968—LT Stephen Shride at his duty station.

1991—A nurse makes her rounds during Operation Desert Storm.

Corpsmen Scale Cliff to Rescue Accident Victim

In the movie "Point Break" Keanu Reeves, as FBI agent Johnny Utah, pursues four adrenaline-pumping surf junkies to a razor's edge climax high over Mexico's Baja California peninsula.

HM3 James DeJanon and HN Toshiro Carrington lived it. "Good movie," said DeJanon. "It's about the beach, surfing, and action. I grew up next to the beach, like to surf, and love adventure." The two Naval Medical Center San Diego corpsmen took their own walk on the wild side of Baja recently and walked away as heroes.

DeJanon and Carrington had spent "a really great day" scuba diving off the coast of La Bufadora, south of Tijuana, Mexico. "The diving was excellent. The water was clear, and the underwater landscape was stunning," recalls DeJanon. While pulling their gear together at the end of the day, the fatigued Navy corpsmen suddenly heard the scrubbing of rubber tires on asphalt and dirt and turned to watch a large truck wheel go over the side of the cliff they had just climbed.

"It happened just like that," DeJanon said, snapping his fingers and shaking his head. "I'm just packing up, and then I hear a lot of people gasp and turn around in time to watch two wheels disappear over the edge."

DeJanon immediately turned to Carrington: "Get my kit," he said. The corpsmen carried an extensive first-aid pack. Hooking it on the run, DeJanon and Carrington skidded back down the 75-foot cliff to the site of a scene right out of another movie, "Jurassic Park." Like a wounded dinosaur, the large cab lay twisted on its passenger side in the rising tide of La Bufadora's surf line—with the tide coming in and darkness descending.

Wading out to the truck's cab, both corpsmen reached in and began assessing the driver's injuries. "It was difficult," Carrington remembered. "We had to reach through the broken windows and attempt to assess while the driver was pinned to his seat. I was telling Jim (DeJanon) everything I could determine. We performed the standard assessment as best we could," DeJanon added. "We checked first for anything life-threatening. His ABC's (airway, breathing, and circulation) were intact but not stable. Both his legs were broken; I could feel his bone jutting from his skin. My initial concern was getting him out of there."

Both DeJanon and Carrington are trained emergency medical technicians with months of training and years of experience between them. They immediately applied their field experience to the task. Fortunately, DeJanon is fluent in Spanish and was able to gain immediate control at the scene.

"He made everything go a lot faster," said Carrington. Good thing. By now the tide had risen significantly. Water, blood, and fuel were swirling in and out of the cab. The engine was still sparking. And to make matters worse, spectators had arrived and began to descend the cliffs to watch and take pictures. Some panicked and were screaming. "It was chaos," DeJanon recalled.

A Mexican ambulance and contingent of Federales arrived. According

HM3 DeJanon at work

to Carrington, however, "One of the officers just videotaped everything and none of them were controlling the crowd."

Amidst the clamoring, DeJanon and Carrington began to plan the driver's extrication. DeJanon barked orders to bystanders who could help. Once the truck's steering wheel was pulled back, they could then slowly pull the accident victim through the cab's windshield frame.

"The patient must have been tough," Carrington said. "I know he was in a lot of pain. If that had been me, I would have been screaming." The extrication took 72 agonizing minutes. DeJanon, speaking in the driver's native language, reassured and calmed him as he was slowly pulled from the wreckage. Once the victim was free of the cab, the corpsmen completed their assessment and prepared him for transportation in the ambulance waiting at the top of the cliff. A backboard had been sent down hand over hand, upon which they laid the injured driver, lashing him in. Once more, they needed to scale that cliff, this time with a patient. They chose their course carefully, straight up with the weight of the severely injured victim distributed between them. The cliff was a rocky wall, wet and slippery.

"It was slow," DeJanon said, indicating with his hands the angle of their ascent, like a fighter pilot describing an angle of attack. "The cliffs were steep, and we slipped a couple of times, but we made it up the side together. Our biggest fear was falling," added Carrington. "We could have been three casualties instead of one down there."

At the roadside, DeJanon turned the patient over to Mexican paramedics. "At least we thought they were paramedics," he said. "I think they may have been just drivers with no emergency medical experience." They invited DeJanon to ride with them to the nearest medical center. On the way he started an IV.

It was later reported that the patient recovered, but DeJanon and Carrington kept the event to themselves. "We didn't think we did anything out of the ordinary, anything anyone else with our training wouldn't do." Still, the coordinators of the diving trip from which DeJanon and Carrington were returning wrote a letter detailing the event to the commanding general of the Marine Corps Recruit Depot. DeJanon and Carrington are now nominees for the Navy and Marine Corps Medal for their heroic feat. □

—Story by H. Sam Samuelson, reprinted from *The Drydock,* San Diego, CA, 4 June 1993.

The Gospel on Leadership According to John

CAPT John B. Cotton, MC, USNR

The following is adapted from a speech given to the Fleet Hospital meeting at the Association of Military Surgeons of the United States (AMSUS) in Nashville, TN, on Sunday 15 Nov 1992, and represents the feelings, thoughts, and experiences of the author.

"Leadership—what is it anyway," as Andy Rooney might ask? Well, it's kind of like trying to describe the universe, then give two examples. I tend to think of it more like obscenity—it's hard to define, but I know it when I see it! So I looked it up in Webster's:

Leadership—the position or guidance of a leader. Right! So what's a leader?

Leader—a person that leads, guides, or directs; a nautical leader is a wooden block with a hole in it.

So then what does it mean to lead?

To lead—to guide by holding the hand; to guide by showing the way; to induce by going first, to conduct as a commander.

B.H. Hart describes a leader thusly—a commander—should have profound understanding of human nature, the knack of smoothing out trouble, the power of winning affection while communicating energy, and the power of ruthless determination where required by circumstances. He needs to generate an electric current, and to keep a cool head in applying it.

Being a physician, nurse, dentist, or Medical Service Corps officer is just not enough! Each of us must first be a naval officer and a leader. Possessing a college degree and wearing a gold collar device does not automatically endow you with qualities of leadership—you must work at cultivating leadership in your daily lives, then practice it and live it while in uniform. Respect and loyalty cannot be demanded, but must be earned.

When I reported for my first active duty assignment as a brand-new lieutenant aboard USS *Rockbridge* (APA-228) fresh out of Officer Indoctrination School in 1968, I asked my chief corpsman, (once I figured out exactly who the chief was) what I should do to become a good officer? He said, "Just three things: be in the right uniform, be in the right place, and be on time—I'll take care of everything else"—and he did!

As the years have gone by I've tried to practice the chief's advice. However, as I have hopefully grown in wisdom, remembering how wisdom is obtained, I've added a few items to the chief's original list. I've learned these principles from people of all ranks and rates that I considered to be good leaders, or those who've possessed distinct leadership traits I thought to be worth adapting.

I recall the master gunnery sergeant at Mountain Warfare School at Check Point Charlie who directed and motivated his men by addressing them "as gentlemen and professionals," and never raised his voice. Prior to that, I thought Marines were motivated only by verbal bludgeoning. I also recall the Marine captain who directed the deployment of a battery of mechanized 8-inch howitzers so efficiently that it looked like a choreographed dance.

Others I have learned from include my present command master chief, HMCM Robert Syler, who demon-

strates great compassion for his enlisted people, and never, but never, lets me forget about the proverbial Seaman Jones. Historical leaders as Abraham Lincoln, Robert E. Lee, Douglas MacArthur, and even Prince Charles of Britain have had profound influence on my leadership style.

So now instead of 3 points I have 10. I thought about calling them the Ten Commandments, but that might be a bit presumptuous. Then I thought about Ten Points of Light, but President Bush already used that, so I'll just call them my Ten Suggestions of Leadership. I would like to share them with you.

1. Let those subordinate to you know what you expect of them. They will live "up to" or "down to" your expectations. My expectations of Fleet Hospital-21 personnel are few and simple:

- **Be in the right place.** It will do you no good to be at the train station if we're mustering at the airport for deployment.
- **Be in the right uniform.** This may be service dress blues or it may be "cammies" with two full canteens of water, duce gear, a unit one, and a side arm and may make a difference in saving your own life or that of your shipmate.
- **Be on time.** Some things in life happen only once then are forever gone without a second chance—the ship only sails once, the aircraft cannot come back for you, or if you miss the last truck out of the desert you may die.
- **Communicate.** This may be the most difficult expectation to accomplish because it involves information being sent correctly, received and interpreted correctly, and acted on correctly.
- **If it doesn't benefit Seaman Jones or PFC Jones perhaps it isn't worth doing.**

2. You can't lead if you are standing in the back. Be a part of everything possible in your detachment. If there's a:

- **Class**—Be in it, or teach it.
- **Muster**—Be there.
- **PFT**—Run it.
- **Formation**—Be in front.

3. Look the part. You are as you appear to your units, either favorable or unfavorable. Neither a superior, pompous attitude, nor a "good buddy" atmosphere will be rewarded with respect and loyalty. Both will be responded to by resentment and poor morale. Always look and act the part of your rank and office. *You* set the tone and attitude of your detachments. Whether you realize it or not, you are inspected by many sets of eyes at every drill. You can learn a lot by just sitting quietly and listening in the mess hall. Your troops are very observant. If unkempt dress or improper behavior seem acceptable for you, count on it becoming the norm for your people.

4. Use the chain of command. If you expect others to use it, you must use it yourself. If used improperly by you or your troops, you are likely to become fouled in it and "fall on your sword."

5. Delegate authority. Don't micro-manage, but *do* hold others responsible and accountable for their actions. Give everybody a job and hold them accountable for it.

6. Avoid "elitism" in yourself and don't allow it to develop and fester in your detachments. This behavior is definitely bad for morale. Have just one set of rules for everybody, and don't hold yourself or others above it.

7. Give praise in public and before the group, and never reprimand anyone in public. Its embarrassing for everyone and belittles you. Think back to coach Tom Landry of the Dallas Cowboys. On television or at the game, you never saw him berate a player during the game. That came on Monday in his office. Always try to correct or punish without breaking the individual's spirit.

8. Show sincere interest in your troops. Be sure they are fed, clothed, and paid. Just these three things will go a long way toward keeping good morale. Perhaps you should inquire about problems early Saturday morning of a drill weekend, so they may be addressed before drill is over, instead of waiting until Sunday afternoon when it is too late. I recommend you conduct a personnel inspection every Saturday morning at first muster. This gives you the opportunity to greet and shake hands with every member and to give praise and compliments. Your troops deserve it!

9. Be quick to praise a job well done. We all respond to positive strokes, but be sure the reward fits the action. Otherwise, praise becomes meaningless.

10. Accept the fact that you don't know everything. Be willing to learn from anyone of any rank or position. PFC Jones may not know anything about chest surgery, but he most likely can run circles around you in the use of the M-16, or how to survive in a hostile environment. Seek advice from knowledgeable people—you both will learn from the experience. As Mark Twain said, "We're all ignorant—just about different things."

If you don't remember anything else, please remember this: If it doesn't benefit Seaman Jones or PFC Jones, perhaps it shouldn't be done. Seaman Jones is young and needs you to guide him and show him the way. PFC Jones is our sole purpose to exist, for he is our patient. Finally, if all else I've suggested fails or falls on deaf ears, simply follow the golden rule and you will do the right thing. □

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A Comparison of Navy and Civilian Health Habits

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The importance of health promotion and physical fitness has gained wide support in both the private and public sectors. A multisite study using an interdisciplinary team screened 152 subjects from Navy and civilian populations. Total cholesterol:high-density lipoprotein (HDL) cholesterol ratios, chronological age, blood pressure, heart rate, and health risk factors were compared. Results show cholesterol:HDL ratios and arterial blood pressures higher in Navy than civilian populations (p .05) with a significant percentage of Navy subjects with HDL ratios greater than 5.0. Job stress was higher in civilian subjects; however, the health risk appraised age was greater than chronological age in Navy subjects. Identification of high-risk factors and interventions designed to promote healthy living which could lead to positive behavior/lifestyle changes can easily be accomplished at the worksite.

Escalating health care costs in the United States have resulted in a heightened awareness of the importance of health promotion and physical fitness. Physical fitness and readiness are hallmarks of all branches of military service. Health promotion is an important variable in the formula to contain health costs but yet is not always an identified priority. Effective health promotion within our health care delivery system is elusive. However, the necessity for an effective health promotion program is readily apparent when examining total costs of health care for the military health services system. In fiscal year 1990, this amount totaled $14,089,502,000, of which the Navy's portion was $3,863,066,000.(*1*) According to the Office of National Health Statistics, the $671 billion spent by the United States on health care in 1990 constituted the largest share of the gross national product ever spent on health care.(*2*) Currently in the civilian sector it has been estimated that over $800 billion is spent annually on health care.

With the ever-increasing cost of health care in the United States, it is becoming more expensive than ever to be in poor health. Many of the most serious health problems affecting Americans today, however, are those that could be prevented or diminished by practicing good health habits.(*3*) There have been many studies which examine the relationships (1) between lifestyle and health status,(*4*-

TABLE 1
Mean Comparisons

	Total Sample (N = 152)	Navy (N = 100)		Civilian (N = 52)		p
		M	SD	M	SD	Value
Chronological age	37.1	35.5	7.59	40.2	9.50	0.001*
Appraised age	37.0	36.2	9.03	38.6	9.45	0.14
Year employed	12.1	13.5	6.77	9.0	7.83	0.0004*
Perceived stress	6.28	6.13	2.00	6.56	2.12	0.22
Perceived job satisfaction	7.18	6.90	2.10	7.71	2.07	0.02*
Perceived health	7.69	7.54	1.74	7.98	1.77	0.14
Cholesterol	191.1	196.2	43.19	181.4	38.50	0.03*
HDL	46.1	45.6	12.68	49.5	11.23	0.26
Cholesterol:HDL ratio	4.54	4.53	1.56	4.35	1.23	0.04*
Heart rate	77.86	77.09	12.13	79.33	11.03	0.27
Mean arterial pressure	106.67	111.13	11.75	98.10	13.59	0.00001*
Systolic blood pressure	133.6	138.99	14.32	123.10	16.64	0.00001*
Diastolic blood pressure	77.7	80.23	10.75	72.96	10.95	0.0001*

* $p \leq 0.05$

6) (2) between various risk factors and increased morbidity,(*7-10*) and (3) explore determinants of health-promoting behavior.(*11-15*) This widespread interest in health promotion is partly in response to the harsh economic reality confronting the American public seeking health care today. Employers, including the Navy, are taking a close look at ways to minimize health care costs of employees. The workplace is a key area not only for identifying individuals at possible health risk but also for planning health-related activities.

The Navy has a long history of commanding a high level of physical fitness among its members. In addition to maintaining a satisfactory level of physical fitness, Navy personnel are given the responsibility for maintaining an optimum level of health. The Navy is currently concentrating its health promotion efforts in the areas of (a) smoking prevention and cessation, (b) alcohol and drug prevention, (c) stress management, (d) nutritional education for weight control, (e) back injury prevention, (f) physical fitness and sports, and (g) hypertension screening, education, and control.(*16*)

The Navy's emphasis on physical fitness (through the Physical Readiness Test) and wellness of its members (through individual command health promotion programs) in the interest of maintaining an optimum level of physical readiness corresponds with the growing interest in worksite wellness in the corporate community. With such an emphasis on physical fitness and wellness in the Navy it was assumed that Navy personnel would demonstrate fewer health risks than a civilian population. The specific research question this study asked was, what was the level of wellness of select active duty Navy personnel as compared with an employed civilian population as reflected by health risk appraised age versus chronological age and identified risk factors?

Methods

This descriptive survey study was pilot in nature and based on the epidemiological model. Data at each site were collected using an investigator designed demographic questionnaire, the Kendall Blood Pressure Monitor model 8200, the Abbott Vision portable serum cholesterol analyzer, and the University of Minnesota-Health Risk Appraisal (UM-HRA). Selected variables of age, sex, cho-

TABLE 2
Frequencies of Military Good Health Habits Practiced (N=100)

Good Health Habits	Men n = 89		Women n = 11		Officer n = 25		Enlisted n = 75	
Non-smoker	58	65%	6	54%	23	92%	41	54%
Little or no alcohol use	46	51%	7	63%	12	48%	41	54%
Low systolic BP	40	44%	8	72%	17	68%	31	41%
Low cholesterol	29	32%	6	54%	14	56%	21	28%
Use seat belt	60	67%	8	73%	21	84%	47	63%
Does not speed	80	90%	11	100%	25	100%	66	88%
Low violence risk	84	94%	9	82%	25	100%	68	91%
Good physical activity	49	55%	6	55%	18	72%	37	49%
Regular self-breast exam	--		6	55%	2	8%	4	5%
Good self-reported health	30	34%	2	18%	14	56%	18	24%
Regular breast check-up	--		1	9%	--		1	1%
Regular rectal exam	27	30%	--		8	32%	19	25%
High HDL	15	16%	1	9%	5	20%	15	20%

lesterol levels, cholesterol:HDL ratios, blood pressure, mean arterial pressure, heart rate, overall stress, perceived health, job satisfaction, cigarette smoking, and appraised health age were analyzed in this study.

Data were collected at a training seminar for the Navy participants and at the workplace for the civilian subjects. A convenience sample of currently employed adults were selected for the study. Active duty Navy personnel stationed at a shore-based command center and attending a training seminar were invited to participate in a health risk appraisal. Civilian subjects participating in education work-related conferences were likewise invited to participate. All subjects expressed willingness to participate. Participation in this study was strictly voluntary. Anonymity was assured as each subject was assigned an identification number upon entering the study site. Upon completion of the study all subjects were given a copy of their individual results along with appropriate health-related brochures and an opportunity to discuss the results with a health care provider.

Data in this report were analyzed using demographic statistics and the unpaired *t*-test. The data were adjusted to account for differences in sample size. The acceptable level of significance was set at 0.05.

Findings

One hundred fifty-two (100 Navy personnel, 52 civilian personnel) participated at two study sites. Civilian subjects were older in chronological years but had a younger mean appraised health age. Navy subjects had a mean health risk appraised age which was greater than their chronological age thus demonstrating this population to be at more of a potential health risk.

When examining physiologic factors which place an individual at risk, civilian subjects generally had better findings than did the Navy subjects. A significant difference was found for the risk factor variables of cholesterol, cholesterol:HDL ratio, mean arterial pressure, and systolic and diastolic blood pressure. Civilian subjects demonstrated greater perceived stress, but better job satisfaction and perceived health than Navy subjects.

The frequencies of self-reported health habits practiced according to gender and officer/enlisted status of the Navy sample demonstrates differences among group categories. "Non-smoker" was listed as a good health habit by 92 percent of the officers with only 54 percent of enlisted personnel reporting the same. The good health habits "low cholesterol" was not evenly divided across groups, nor was "high HDL" listed frequently for any Navy subject groups.

Factors Affecting Findings

Survey research findings generally should be viewed with some caution due to the one-time testing of subjects. However, in this study all equipment was calibrated prior to data collection and all procedures and methodologies were standardized. American Heart Association 1990 guidelines were followed for resting blood pressure measurements. Cholesterol levels analyzed by the Vision analyzer had coefficients of variation of less than 3.0 percent for total cholesterol. These values are well within the targeted range established by the National Cholesterol Education Program. Extraneous factors such as recent food and caffeine consumption and activity level were controlled.

Discussion of Data

Navy subjects in this study did not demonstrate as many positive physiologic findings as did the civilian group. This finding is of interest due to the assumption that Navy personnel would demonstrate greater positive health findings due to their younger age, continued medical care, and physical fitness requirements.

It is known that the major health problems in the United States today are ones which to a large degree are preventable. Research from the past few decades has shown a significant relationship between lifestyle and physical health, indicating certain behaviors have an impact on a person's level of health.

The limited sample size in this pilot study does not allow for the results of this sample to be generalized to the working population in either military or corporate settings. This initial data collection warrants further study and examination. However, individuals interested in worksite screening programs can use physiological results coupled with HRA's as a basis for intervention programs. Wellness screening conducted in-person, one-to-one, with measures of blood pressure and cholesterol as well as other health risk information may serve as a possible motivator for lifestyle changes.

Conclusions

Many behavioral choices affect an individual's health status. Identification of and interventions designed to assist individuals in the workplace may promote healthy living and thus decrease health care costs for the employer. The time is ripe for a proactive position on health care delivery. Foremost in this move must be a commitment for the promotion of health to enhance the quality of life for all. Programs directed at controlling such health risks as hypertension, hypercholesterolemia, and smoking command a long-term commitment and realistic approach in light of the prolonged period of time necessary to reflect results of such programs. Further research will be necessary in order to build a strong knowledge base for the stance of health promotion.

References

1. Boyer J. *Report of Health Care Expenditures FY 1990.* Washington, DC: Department of the Navy, Pentagon, 1991.
2. Levit K, Lazenby H, Letsch S, Cowan C. National health care spending 1989. *Health Affairs.* 1990;10:117-130.
3. Fielding J. Health promotion and disease prevention at the worksite. *Ann Rev Public Health.* 1984;5:237-265.
4. Belloc N. Relationship of health practices and mortality. *Prev Med.* 1973;2:67-81.
5. Wiley J, Camacho T. Lifestyle and future health: evidence from the Alameda County study. *Prev Med.* 1980;9:1-21.
6. Schoenborn C. Health habits of U.S. adults, 1985: the "Alameda 7" revisited. *Public Health Rep.* 1986;101:571-580.
7. Jeffay H. Obesity and aging. *Am J Clin Nutr.* 1982;36:809-811.
8. Simopoulos A, Itallie T. Body weight, health and longevity. *Ann Intern Med.* 1984;100:285-295.
9. Fries J, Green L, Levine S. Health promotion and the compression of morbidity. *Lancet.* 1989;1:481-483.
10. Nowack K. Coping style, cognitive hardiness, and health status. *J Behav Med.* 1989;12:145-158.
11. Eiser J, Gentle P. Health behavior as goal-directed action. *J Behav Med.* 1988;11:523-535.
12. Sloan R, Gruman J. Participation in workplace health promotion programs: the contribution of health and organizational factors. *Health Educ Q.*1988;15:269-288.
13. Dishman R, Sallis J, Orenstein D. The determinants of physical activity and exercise. *Public Health Rep.* 1985;100:158-171.
14. Davis X, Jackson K, Dronenfeld J, Blair S. Determinants of participation in worksite health promotion activities. *Health Educ Q.* 1987;14:195-205.
15. Miller R, Golaszewski T, Pfeiffer G, Edington D. Significance of the lifestyle system to employee health and assistance. *Health Values.* 1990;14:41-49.
16. Secretary of the Navy. *SECNAV Instruction 6100.5 Health Promotion Program.* Washington, DC: Department of the Navy, Pentagon, 1986. □

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Navy Medicine May-June 1943

Jennifer Mitchum

The New Georgia Islands, approximately 170 miles northwest of the Russells, was the next stop in the Allied offensive. New Georgia contained several staging points from which the United States could ferry supplies and troops to other battle areas. Moreover, the Japanese had completed an airfield at Munda Point on the northwest corner of the main island of New Georgia and were in the process of building a second air base near the mouth of the Vila River on Kolombangara Island.

Photos from BUMED Archives

These bases hereby threatened U.S. installations not far off. Prior to May 1943, U.S. fliers conducted a number of successful raids on Japanese airfields, but none interrupted their use for more than a day or two.

Therefore, the Allied leaders decided to invade the New Georgia Islands. Under the invasion plan, a combined Army, Navy, and Marine force was to land simultaneously in several places in the New Georgia area.

Staging Points: Guadalcanal and the Russells

Under the plan, Allied troops were to spring their attacks from Guadalcanal and the Russells. Thus, medical and logistic problems had to be addressed and corrected on these islands.

Medical personnel aimed to reduce the possibility of invasion troops contracting malaria while passing through Guadalcanal. ". . . if we are able to prevent them [the troops] from contracting the disease at Guadalcanal so that they are malaria-free on reaching

A battalion aid station on Guadalcanal.

Risking their lives to save a comrade, marines carry a casualty to safety under heavy sniper fire.

the combat zone, they will be much less likely to contract malaria during the fighting as the natives (seed bed) will not be in the combat area,"(*1*) wrote CAPT Arthur H. Dearing, MC, in a letter to RADM Ross T. McIntire.

Viewed as an area problem, eradicating malaria from Guadalcanal would be difficult. "The prevention of mosquito breeding in the combat area is a difficult proposition and although I am sure that we can do better than was done on Guadalcanal, I fear we will always have a high incidence of malaria amongst our combat troops," (*2*) noted Dr. Dearing.

Medical personnel in the Russells continued to tackle problems such as malaria, fungus infection, and jaundice. Twenty-five men were evacuated in May.(*3*) In June, battle casualties increased. One unique injury was suffered by LT S.S. Logan, who lost his left foot to a Japanese propeller while parachuting to the ground. The Japanese pilot had first attempted to machine gun the American as he floated beneath his canopy.

Segi Point Taken Early

On 21 June, attack transports *Dent* and *Waters* crept past the western coast of Vangunu Island in poorly chartered waters and debarked two companies of the Fourth Marine Raider Battalion at Segi Point, New Georgia. The Americans hit Segi Point first in order to establish a forward airfield and to deny the area to the Japanese.

On 30 June, Acorn 7 arrived at Segi Point. Half the medical department accompanied the first wave; the remaining half was due to arrive in July. Upon landing, first wave medical personnel established a first-aid station and three four-bed tent wards. Subsequently, the Seabees cleared a site about one-half mile from the beach and erected a 100- by 16-foot ward. Shortly thereafter, additional buildings including a surgery and X-ray building and two additional wards were erected. Hospital corpsmen then manned several stations including the crash boat and truck, the ambulance, and the airfield first-aid station.

The Major Offensive

On the morning of 30 June, forces landed according to plan at several points in the New Georgia area. The first wave landing on Rendova included about 600 Seabees tasked with preparing beaches for landing of small boats and pushing roads into the jungles. The Seabees' camp, about 700 feet from the front line, had a sick bay and hospital tents. Two 16- by 10-foot tents with cots served as wards and a 16- by 16-foot pyramidal tent served as a dispensary. Because of poor road conditions, personnel had to carry patients from the camp to LST's for evacuation.

Enemy on New Georgia

The Japanese had intended to develop New Georgia as a major base, but were never able to muster sufficient manpower in the islands to do so.

At the time of the U.S. landings, most enemy garrisons had been in the vicinity between 5 and 9 months. American intelligence learned that during that time the Japanese increasingly suffered from disease and starvation which inevitably weakened their forces and made our seizure of the islands less costly. Malaria was a principal factor. Most of the enemy troops had contracted the disease in New Britain or Bougainville prior to coming to the central Solomons. The incidence was believed to have exceeded 30 percent by June 1943.(*4*) In contrast, incidence of malaria in Allied troops in the central Solomons did not rise "over five percent per month and was never a serious impediment."(*5*)

The Aleutians

Paralleling the south and central Pacific Solomons campaigns was another U.S. offensive under way far to the north. In the summer of 1942, the Japanese occupied several of the Aleutian Islands—most importantly Attu and Kiska. By May 1943, U.S. forces were prepared to take them back.

The morning of 11 May, U.S. forces landed on Attu with naval units providing fire support and air cover for Army troops. In the bitter fighting that followed, Navy medicine's focus was aboard vessels at sea. The beach party of USS *J. Franklin Bell* (APA-16) evacuated 100 casualties to Adak between 11 May and 16 May.(*6*) About 20 of these were shipboard and boat incidents. One such incident

On Attu, sailors examine equipment abandoned by a Japanese medical unit. Beneath the surface, the enemy had constructed an underground village of interlacing tunnels.

occurred during an enemy torpedo attack when a landing boat fell and crushed a man to death. Foul weather hampered shore-to-ship evacuation.

Cold weather, wet terrain, and ill-fitting leather boots caused about 260 cases of immersion foot, a condition as likely to put a man out of action as a bullet. The patients, many of whom had been in foxholes on snow-covered mountain slopes for up to 7 days, came aboard USS *Heywood* and were assigned to a troop compartment. The compartment was purposely unheated with the temperature hovering around 50° F. During this initial period, patients received codeine and aspirin to alleviate pain. After several days, the temperature in the compartment was brought to a comfortable room temperature. Consequently, swelling went down and devitalized tissue separated as a dry gangrene in one or several of the patients' toes after about a week.

Although patients came aboard *Heywood* shivering and complaining about the cold, medical personnel reported very few cases of initial shock and an extremely low infection rate.(*7*) On 6 June, *Heywood* pulled into port at San Francisco with nearly 500 wounded of the Attu campaign.(*8*)

Because of its exceptional facilities—which included a sick bay with six permanent berths, a small operating dispensary, and an operating room—medical personnel aboard USS *Spica* were able to aid ships and smaller crafts that were unable to reach shore due to inclement weather. *Spica* had been sailing Alaskan waters loading and unloading cargo at American outposts on the Alaskan coast and Aleutian Islands. Medical personnel reported no fatalities or serious injuries.(*9*)

Aboard ships, lectures and films stressed preventive medicine, first aid, and treatment of burns, wounds, fractures, hemorrhages, shock, and sunstroke. In addition, personnel frequently instructed stretcher-bearers and corpsmen in artificial respiration and proper handling of the injured, particularly those with head injuries and fractures. Moreover, medics conducted inoculations and constantly inspected food stores and mess areas.

In some cases, medical personnel performed under adverse conditions. The medical team aboard USS *David W. Branch* performed a successful operation in an area so confining that it was difficult to stand around the operating table.(*10*) Similarly, USS *Indianapolis*'s physicians performed surgery in an operating room recently damaged in a ship-to-ship collision. When a surgical emergency arose that evening, medical staffers patched a hole in the hull with canvas and proceeded with an operation. Interestingly, the medical personnel aboard *Indianapolis* reported that the task of patrolling and blockading in the Aleutians was more physiologically and psychologically wearing on the ship's crew than actual combat.(*11*)

Overall, the morbidity rate was low at Attu. Ship confinement and lack of contact with natives equaled the best preventive medicine measures. By using lifesaving drugs, plasma, and by rapidly transporting wounded to area medical facilities, mortality was reduced. Moreover, respiratory infections seldom occurred in the Aleutians. USS *Hatfield* medical personnel reported that despite extremely low temperatures and an ice-coated ship, crewmembers did not develop colds until they put into a U.S. port.(*12*)

Prison Camps

Thousands of miles south of the Aleutians, American POW's held in the Philippines heard about the American offensive. ". . . Their [local press] war news is scanty, and where it is given, we can read enough between the lines to know that the enemy are beginning to feel the pressure," wrote CDR T.H. Hayes, MC, in his journal while interned at Bilibid.(*13*)

War prisoners in Japan also heard about the Allied offensive in degrees. Newspapers indicated that Germany was being hard pressed, but the Japanese maintained that their forces were being 100 percent successful. In reference to the Aleutians, newspapers reported that the Japanese fought to the last man at Attu and that the United States lost 6,000.(*14*)

As Allied pressure increased on the Axis, those interned were feeling the squeeze as well. The "vacation" of sorts Bilibid prisoners enjoyed during the earlier months of 1943 had come to an end. In the latter part of March, the Japanese discontinued academic classes they had offered at Bilibid.

Moreover, the captors forbade group formations except for religious, entertainment, and athletic purposes.

Those at Bilibid and in work details suffered from dysentery, malaria, and diphtheria. In addition, cholera became rampant in both Cabanatuan and Bilibid. The Japanese supposedly had no treatment for cholera, and Bilibid medical personnel only had enough vaccine for each staff member to get one shot.

By the end of June, the food situation had severely worsened throughout the Pacific islands. "The Japanese chow allowed us has deteriorated so, even from the inadequate miserable dole that it was, that just plain dry rice is all that is fit to eat and they are putting a squeeze on that," noted Dr. Hayes.(*15*)

Deficiency diseases were on an upsurge. Many in the camps died from starvation and other curable diseases because of slack diet and lack of medicine. On 7 June, Dr. Hayes noted in his journal that about 50 percent of the prisoners that had come over from Bataan and Corregidor had died, primarily from starvation and brutality.(*16*) Incidentally, the Japanese brought several guinea pigs to the Bilibid prison hospital to be used as test animals in experiments conducted to find cures for such ailments as tuberculosis.(*17*)

In other camps the situation was reported to be much worse than Bilibid. On 13 June, a draft arrived at Bilibid from the Palawan camp with horrible stories of camp conditions. They said that morale was completely gone and that the men had been "reduced to animal existence."(*18*) Sex perversion was said to be rampant in the camp and that there were no clothes, no shoes, and hardly enough food to survive.(*19*) Work conditions were such that prisoners worked nearly nude in the jungle. Brutalities occurred daily. With practically no medicine in the camp, the men suffered from pellagra, scurvy, beriberi, malaria, and dysentery. In desperation, many fled to the hills.

As in the Philippines, food was by far the major concern in Japan. CAPT R.G. Davis, MC, who had been interned in the Karenko camp in Japan since August 1942, noted in his journal that the Japanese rations were very scant and many of the internees who were nearly skin and bones would have died but for occasional Red Cross packages.

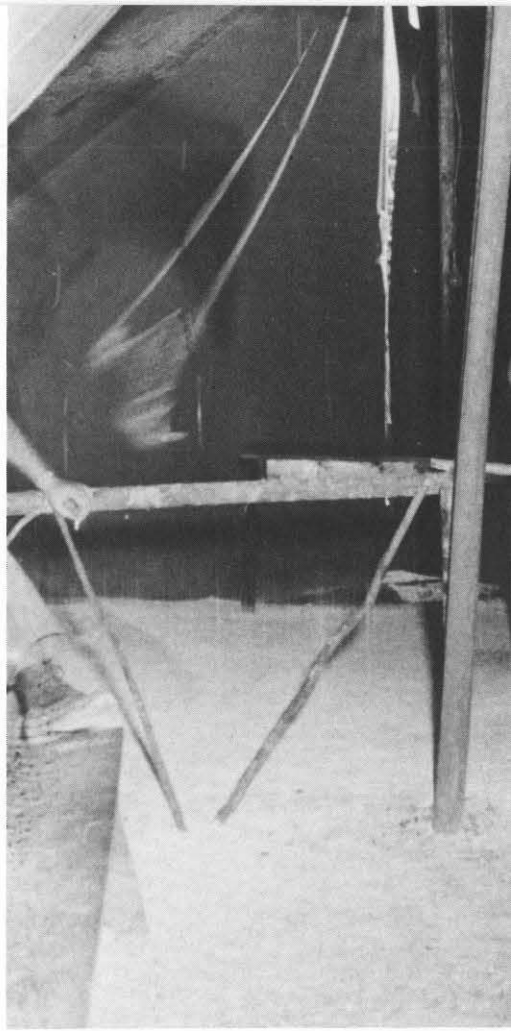
With a promise of more favorable conditions, internees at the Karenko camp were transferred to Shirakawa in the early part of June. Shirakawa, 150 kilometers north of Takao on the west coast of Taiwan, was the land of plenty with acres of rice, sugar cane, sweet potatoes, mangoes, and general gardening. The new camp had bungalow-type barracks and was surrounded by a high bamboo fence. A hospital was under construction. Initially, the food situation in the camp improved. But after a few days, food again became scarce.

As war news increasingly favored the Allies, some prisoners perceived that the Japanese were changing their attitude. CAPT Davis noted that his captors seemed to be complying more and more with the Geneva Conventions and that there was a feeling in the camp that the doctors and the sick might be going home by 15 Aug.

". . . The Japanese annihilation is a great shock to them who swear revenge, etc., but now is the time for them to bargain before they experience a total military defeat. Our present status is 180 degree turnabout. We may all get exchanged, but certainly the doctors and the sick," noted Dr. Davis.(*20*)

From Santa Tomas to Los Banos

In May 1943, the Japanese sent 800 men to Los Banos, which was about 60 or 70 miles south of Manila, to set up a new civilian internment camp. The camp, an agricultural college outside Los Banos, had been part of the University of the Philippines. Two civilian doctors and the 11 Navy nurses went with the group to set up a 25-bed hospital unit. "It was quite a hassle putting that little 25-bed unit into a hospital. It

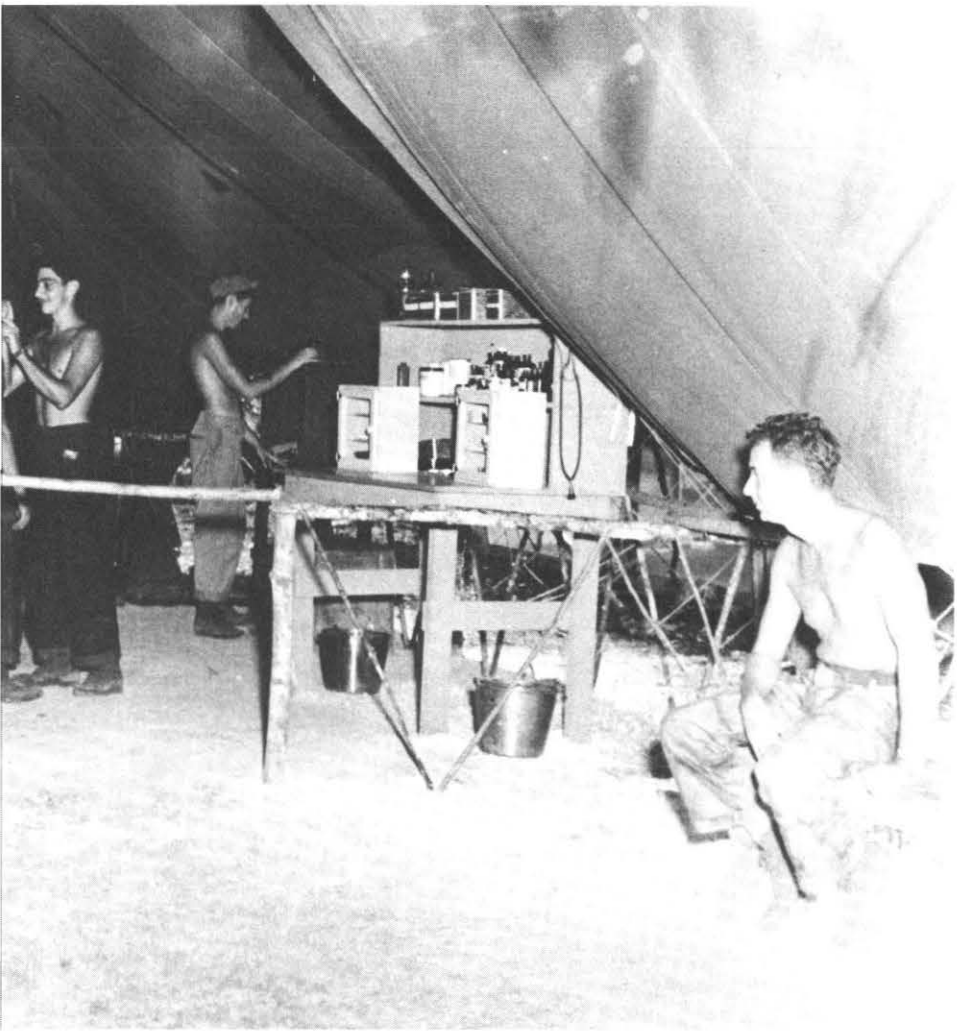


has been abandoned and apparently transient troops—both American and Japanese—had used it as a quarters as they passed through. They had ripped the cupboards off the walls to make wood for fire," recalled Navy nurse Dorothy Still Danner.(*21*)

Medical personnel were creative in stocking the hospital. They constructed hospital beds and operating tables from bamboo and scraps of wood. Moreover, personnel fashioned odd bits of corrugated tin into cooking and medical utensils, and used torn linen and clothing for dressings. While medical personnel established the hospital, other internees were building several barracks that would eventually accommodate about 3,000 prisoners.

Elsewhere

In May, enemy resistance in North Africa ended and the dispensary in Casablanca was commissioned as Base Hospital No. 5. Its location permitted the Naval Air Transport Service and the Air Transport Command, from



Medical personnel examine patients at Munda, New Georgia.

Port Lyautey and Casablanca, respectively, to evacuate patients to the United States more easily.

BUMED made organizational changes and continued its hospital expansion program in CONUS and aboard. In June, base hospitals began to be equipped for 1,000-bed capacity. In CONUS, hospitals were commissioned at Camp Lejeune, NC, and at New Orleans, LA, on 1 May and 1 June, respectively. Base Hospital No. 6 was commissioned on 1 June at Espiritu Santo, New Hebrides, and Mob-9 on 13 May at Brisbane, Australia. Convalescent hospital USNCH Asheville, NC, was also commissioned on 24 May as was USNCH Yosemite National Park, CA, on 23 June.

In way of Navy medical changes, on 29 May, BUMED lowered the dental requirements as to agree with the mobilization requirements of the Army. Only severe and irreparable dental defects were to be used to disqualify inductees. In addition, a Force Dental Officer was assigned to the staff of Commander South Pacific Forces on 1 June.

References

1. *U.S. Navy Medical Department Administrative History, 1941-1945: Narrative History.* Vol I, chap II:38.
2. Ibid., p 38.
3. Ibid., p 36.
4. Ibid., p 45.
5. Ibid., pp 45-46.
6. Ibid., chap IV:2.
7. Ibid., p 3.
8. *Dictionary of American Fighting Ships, Volume III: G-K—Appendices One-Six,* p 323.
9. *U.S. Navy Medical Department Administrative History, 1941-1945: Narrative History,* chap IV:5.
10. Ibid., p 6.
11. Ibid., p 4.
12. Ibid., p 9.
13. Hayes TH. Journal, part II, p 166.
14. Davis RG. Journal, p 51.
15. Hayes TH. Journal, part II, p 168.
16. Ibid., p 164.
17. Ibid., p 146.
18. Ibid., p 165.
19. Ibid., p 165.
20. Davis RG. Journal, p 51.
21. Danner DS. Wartime reminiscences of LCDR Dorothy Still Danner, NC, USN, p 57.

Bibliography

Danner DS. Wartime reminiscences of LCDR Dorothy Still Danner, NC, USN. BUMED Archives.

Davis RG: Journal, BUMED Archives.

Dictionary of American Fighting Ships, Volume III: G-K—Appendices One-Six. Naval History Division, Office of the Chief of Naval Operations, Navy Department. Washington, DC: Government Printing Office; 1968.

Dictionary of American Fighting Ships, Volume VI: R-S—Appendices, Submarine Chasers, Eagle-Class Patrol Craft. Naval History Division, Office of the Chief of Naval Operations, Navy Department. Washington, DC: Government Printing Office; 1976.

Eleven Navy and Three Civilian Nurses to Receive Bronze Star Medals for Work in Philippines. Press Release. September 4, 1945. BUMED Archives.

Hayes TH: Journal, part II. BUMED Archives.

History of U.S. Naval Hospitals, vol II: all remaining hospitals including Special Augmented Hospital No. 6 Okinawa. BUMED Archives.

Journal of the Medical Department: January 1939-June 1944. Unpublished handwritten log in BUMED Archives.

Karig W, Purdon E. *Battle Report: Pacific War: Middle Phase.* New York: Rinehart & Co Inc; 1947.

Kentner RW. Journal. BUMED Archives.

Register of Commissioned and Warrant Officers of the U.S. Navy and Marine Corps: July 1, 1943. Washington, DC: Government Printing Office; 1943.

Shearer C. Journal. BUMED Archives.

St. Pierre BE. Wartime reminiscences of Bertha St. Pierre, NC, USN. BUMED Archives.

The History of the Medical Department of the U.S. Navy in World War II: A Narrative and Pictorial Volume. Washington, DC: Government Printing Office; 1953.

United States Naval Chronology, World War II. Prepared in the Naval History Division, Office of the Chief of Naval Operations, Navy Department. Washington, DC: Government Printing Office; 1955.

U.S. Navy Medical Department Administrative History, 1941-1945: Narrative History. Vol I, chaps I-VIII. Unpublished typescript. BUMED Archives.

U.S. Navy Medical Department Administrative History, 1941-1945: Narrative History. Vol I, chaps IX-XVIII. Unpublished typescript. BUMED Archives. □

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Rapid Screening for Biological Threat Agents by the Polymerase Chain Reaction

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CAPT Warren W. Schultz, MSC, USN

New technology to detect and confirm infectious microorganisms rapidly in biological and environmental samples has been a continuing, critical Navy-DOD need. Our goal in this project was to develop a rapid, near-real-time system of high specificity for in-theater detection and identification of biological threat agents. Standard culture methods often require many hours or days to make even a presumptive identification. An alternate approach is to analyze samples for the presence of particular molecules that are unique to the microorganisms of interest.

The polymerase chain reaction (PCR)(*1*) is an enzymatic process by which minute amounts of deoxyribonucleic acid (DNA) can be amplified rapidly, after combining with specific DNA probes called primers. Using PCR, specific gene fragments composed of DNA and representing exact "fingerprints" for particular microorganisms can be multiplied 1 million-fold in less than 1 hour. This amplified DNA can then be readily detected by several methods.

We have used PCR to develop a highly sensitive, highly specific assay system for detecting and identifying microorganisms. A laboratory strain of the bacterium *Escherichia coli* containing a traceable gene for resistance to the antibiotic tetracycline was used to determine sensitivity and specificity. We detected the equivalent of a single bacterium in a sample, and unequivocally distinguished between tetracycline resistant and tetracycline sensitive *E. coli*. Positive identification of bacteria in environmental samples was made in less than 2 hours. We then used the system to identify potential threat agents in laboratory and environmental samples, and to differentiate these organisms from even closely related nonpathogenic bacteria. This technology was deployed to the Persian Gulf during Operations Desert Shield/Storm, where it was used to examine environmental samples for the presence of biological threat agents.

Methodology

PCR was performed in a thermal cycling device (MJ Research, Boston, MA) programmed with three 1-minute temperature steps as follows: melting (denaturation) of the target DNA at 94°C, binding of the organism-specific DNA probes (primer annealing) at 58°C, and DNA duplication (primer extension) at 72°C. This three-step reaction was repeated for 30-40 cycles (Figure 1). Reagents were provided in the Amplitaq kit (Perkin Elmer, Norwalk, CT) and the reaction was performed in accordance with manufacturer's instructions. The DNA primers for the reaction were short fragments of nucleic acid designed to match exactly to specific regions on the target DNA. For *E. coli,* this was the tetracycline resistance gene. For actual threat agents the targets included organism-specific virulence factor genes.

To determine the sensitivity of the assay, the laboratory strain of *E. coli* was grown in Luria broth. Quantitative bacteriology was performed on dilutions of log phase bacterial cultures and a standard curve was prepared based on optical densities measured at a wavelength of 650 nanometers. For each assay, a 10-microliter sample containing a known number of *E. coli* (10^4-10^0) was introduced into the PCR mix and subjected to thermal cycling as described above.

To assess specificity, strains with or without tetracycline resistance were subjected to PCR under identical conditions using the same DNA primers that matched specific regions on the tetracycline resistance gene. Test sam-

ples included pure laboratory cultures as well as aliquots of soil and river water inoculated with known organisms. Other microorganisms also tested by PCR included *Yersinia pestis,* the causative agent of plague, *Bacillus anthracis* (anthrax), and the closely related nonpathogenic bacterium, *Bacillus subtilis.*

To visualize the amplified target DNA, a 10-microliter aliquot of the completed reaction mix and appropriate molecular weight standards were electrophoresed for 30 minutes through a 0.7 percent agarose gel, a process that separates DNA fragments on the basis of size. The fragments were then stained with ethidium bromide, a DNA-specific fluorescent dye, and viewed over ultraviolet light. The appearance in the gel of a fluorescent band at the predicted molecular weight indicated successful amplification of the target gene fragment, and confirmed the presence in the sample of the particular microorganism.

Results

Using this system, amplified target DNA of *E. coli* was detected in samples containing the numerical equivalent of a single bacterium. A single fluorescent band of the predicted size was visible in samples that contained one or more bacteria, as seen in an ethidium stained agarose gel (Figure 2, lanes 2, 3, and 5). Positive identification of tetracycline resistant organisms was made in all samples of *E. coli* that contained the gene, while samples containing as many as 10^5 tetracycline sensitive *E. coli* were consistently negative. The DNA primers for the test pathogens unequivocally identified each of these organisms in a variety of different samples, but failed to recognize even closely related nonpathogenic bacteria (Figure 3).

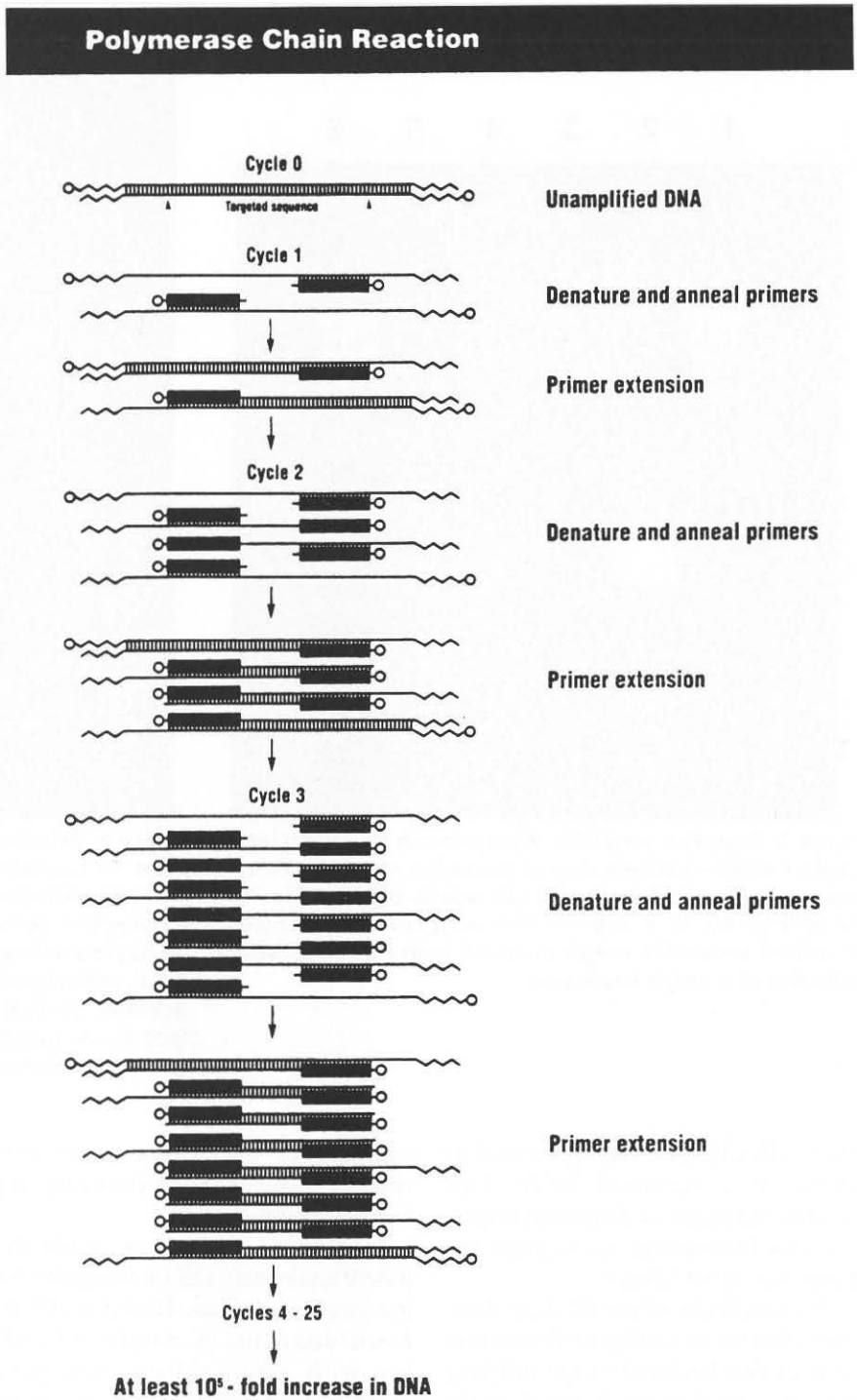

Figure 1. **Polymerase chain reaction. Repeated cycle of DNA denaturation, primer annealing, and primer extension results in rapid amplification of target DNA. (Reprinted with permission Roche Molecular Systems, Alameda, CA)**

Discussion

The six orders of magnitude amplification of target DNA that is generated by the polymerase chain reaction clearly makes this technology the most sensitive diagnostic tool available for clinical diagnosis, biological warfare defense, and research applications. Any microorganism for which a unique DNA sequence is known can be quickly and specifically identified by this technique. In addition, ribonucleic acid (RNA) can serve as the target molecule by preceding the assay with an additional enzymatic step(*2*) in which complementary DNA (cDNA) is first made, using the RNA as a tem-

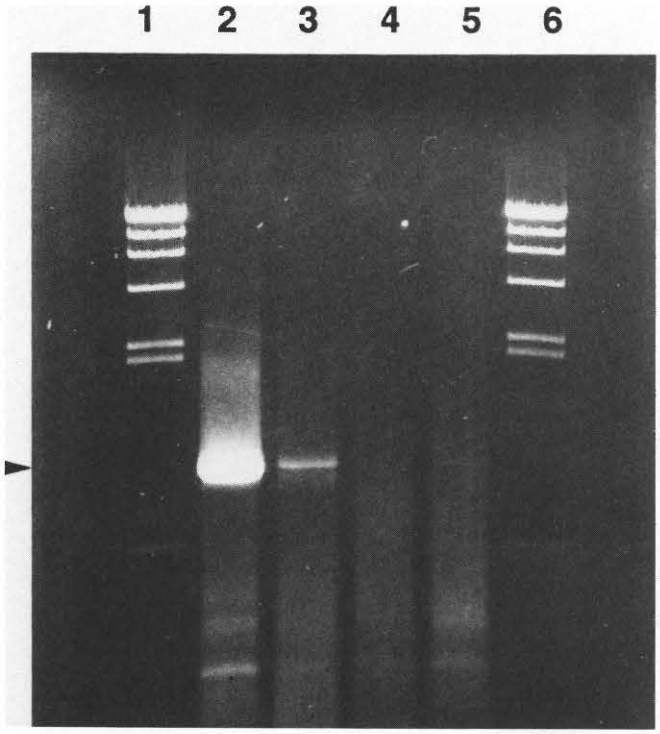

Figure 2. **Detection sensitivity of polymerase chain reaction. Lanes 1 and 6—Lambda Hind III molecular weight markers; lanes 2, 3, 4, and 5 represent the results of PCR reaction containing 100, 10, 0, and 1 *E. coli,* respectively. Faint band of correct molecular weight in lane 5 indicates successful detection of a single bacterium.**

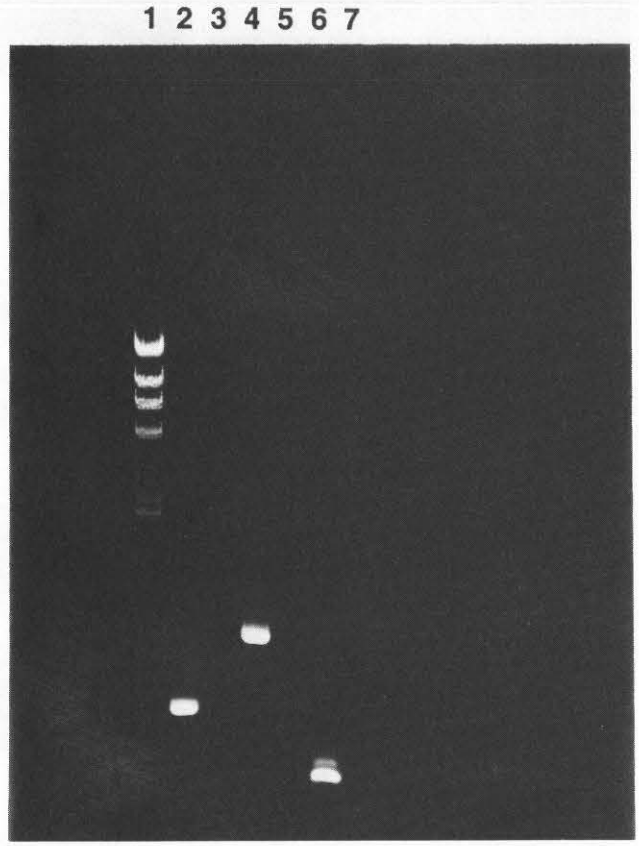

Figure 3. **Detection specificity of polymerase chain reaction. Lane 1—Lambda Hind III molecular weight markers; lane 2—tetracycline-resistant *Escherichia coli* and lane 3—tetracycline sensitive *E. coli,* both tested with probe for tetracyline resistance gene; lane 4—*Yersinia pestis* and lane 5—*Y. enterocolitica,* both tested with probe for plasminogen activator gene of *Y. pestis;* lane 6—*Bacillus anthracis* and lane 7—*B. subtilis,* both tested with probe for lethal factor gene of *B. anthracis.***

plate. The cDNA is then processed as above in a standard PCR. This extends the range of diagnostic targets for this technology to include the numerous RNA viruses.

The specificity of the PCR, as demonstrated by its ability to distinguish between two bacterial strains differing *only by a single gene,* is based on the perfect match that is achieved between the DNA primers and the target DNA to which they bind. Natural or genetically engineered mutations in pathogenic microorganisms can result in changes in their surface features. Current antibody-based diagnostic tests rely on detection of these surface characteristics. Also, normally innocuous organisms can be "weaponized" by engineering into them genes that encode toxins without changing any surface characteristics.

In both of these cases, antibody-based assays may fail to recognize the modified organisms. However, PCR-based diagnosis, by directly interacting with genes rather than gene products, can reliably detect and identify the target despite such changes. Furthermore, since different DNA primers are "invisible" to each other, a mixed panel of primers specific for different microorganisms can be used simultaneously in the same PCR sample to produce diagnostic bands in a agarose gel. This rapid, multiagent capability adds another dimension to PCR-based detection, making it a diagnostic system of unmatched flexibility.

References

1. Saiki RK, et al. Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase. *Science.* 1988;230: 1350-1354.

2. Morita K, et al. Rapid identification of dengue virus serotypes by using PCR. *J Clin Microbiol.* 1991;29:2107-2110. □

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Navy Medicine 1919

BUMED Archives

PhM1c Horace M. Folsom weds Broadway dancer Mary Valis aboard hospital ship USS *Mercy* (AH-4) at Hudson River Pier 45 in New York on 29 May 1919. The ship's commanding officer, CDR Ulys R. Webb, gave the bride away. A Navy band from USS *Agamemnon* played a wedding march. Cooks and bakers prepared a huge wedding cake and a spread of delicacies for a wedding feast. Following the ceremonies, dancing was held on the fo'c'sle.

Photographs of the wedding appeared on the front page of the *New York World* that same day.

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